What is claimed is:

1. An anode-supported flat-tubular solid oxide fuel cell stack using anode-supported tubes, comprising:

a plurality of fuel cells, each comprising:

a supported tube including an upper plate and a lower plate positioned parallel to each other, with semi-cylinders to connect ends of the upper plate to ends of the lower plate, and at least two bridges integrally combined with the upper plate and lower plate as a way to form at right angles to the upper plate and lower plate;

a connector with a rectangular section longitudinally coated on the upper plate of the supported tube as a way to be positioned at a center of the upper plate;

an electrolyte layer partly coated on an external surface of the supported tube except for a portion of the supported tube coming into contact with the connector; and

an air electrode coated on an external surface of the electrolyte layer in such a way that both ends thereof are respectively separated from both sides of the connector by a predetermined distance; and

a plurality of connector plates, each comprising:

a lower connector plate connected to a positive stack electrode at a lower side thereof and having a plurality of first grooves formed parallel to each other on an upper surface thereof, the first grooves each having a depth less than a height of each of the fuel cells by 50% or less;

one or more middle connector plates each having a plurality of second grooves formed parallel to each other on upper surfaces thereof, a plurality of gas channels formed on the upper surfaces thereof as a way to form at right angles to the second grooves and to be positioned parallel to each other, and a plurality of hexahedral connector protrusions formed on predetermined portions of lower surfaces thereof corresponding in position to centers of the second grooves as a way to be extruded parallel to the second grooves and come into contact with upper surfaces of the connectors of the fuel cells, the second grooves each having a depth less than the height of each of the fuel cells by 50% or less, the gas channels each having a rectangular section with its one side being opened; and

an upper connector plate connected to a negative stack electrode at an upper side thereof and each having a plurality of hexahedral connector protrusions

formed on predetermined portions of a lower surface thereof corresponding in position to the centers of the second grooves as a way to be extruded parallel to the grooves and come into contact with the upper surfaces of the connectors of the fuel cells.

2. A method of fabricating an anode-supported flat-tubular solid oxide fuel cell stack, comprising:

extruding and drying a paste, containing NiO-YSZ powder;

pre-sintering the resulting paste at 1250 to 1400℃ to produce a supported tube;

coating a band-shaped organic layer on a center of an upper plate of the supported tube, coating an electrolyte slurry on an external surface of the supported tube through a wet dipping process, and drying the electrolyte slurry;

removing the band-shaped organic layer from the supported tube and repeatedly degreasing the electrolyte slurry at 200 to 450℃;

co-sintering the resulting supported tube at 1300 to 1500℃;

coating perovskite powder in which Ca, Sr, Mg, Co, or Al is added to $LaCrO_3$ on a portion of the supported tube, on which the organic layer is removed, through a plasma spray coating process to form a ceramic connector on the supported

tube;

coating another organic layer on the ceramic connector, and mixing 10 to 30 wt% $LaSrMnO_3$ powder, 10 to 30 wt% mixed powder of $LaSrMnO_3$ and 20 to 50 wt% YSZ, and 10 to 30 wt% $LaSrCoFeO_3$ powder with 50 to 75 wt% organic solvent and 5 to 40 wt% additive to produce three kinds of air electrode slurries;

sequentially coating slurry containing the $LaSrMnO_3$ powder, slurry containing the mixed powder of $LaSrMnO_3$ and 20 to 50 wt% YSZ, and slurry containing the $LaSrCoFeO_3$ powder on an electrolyte layer one time or more;

removing the organic layer from the ceramic connector;

sintering the air electrode slurries at 1150 to 1250℃ to accomplish a unit fuel cell;

forming a plurality of grooves, gas chanels, and connector protrusions on metal plates made of a metal selected from the group consisting of ducrolloy, a Fe-Cr based alloy, a Fe-Cr alloy containing $LaCrO_3$, Y_2O_3, or La_2O_3, a Cr alloy, and a Ni alloy;

polishing surfaces of the metal plates;

producing slurry for a connector plate containing $LaSrMnO_3$ or $La_{1-X}Ca_XCr_{1-Y}O_3$;

dipping the metal plates into the slurry for the connector plate and repeatedly drying the metal plates one time or more to coat the slurry for the connector plate on

the metal plates;

sintering the resulting metal plates at 1100 to 1350℃ under oxygen partial pressure of 10^{-20} to 10^{-3} atm to form ceramic coated layers on the metal plates to accomplish the connector plate; and

stacking the connector plate and fuel cells to fabricate the anode-supported flat-tubular solid oxide fuel cell stack and connecting stack electrodes to the anode-supported flat-tubular solid oxide fuel cell stack.

3. The method as set forth in claim 2, wherein the paste for the supported tube comprises YSZ powder containing 30 to 60 vol.% Ni and 10 to 50 vol% carbon powder acting as a pore forming agent, and 15 to 30 wt% distilled water, 5 to 20 wt% organic binding agent, 3 to 10 wt% plasticizer, and 1 to 7 wt% lubricant are added to a mixture of the carbon powder and YSZ powder based on a total amount of the mixture.

4. The method as set forth in claim 2, wherein the electrolyte slurry comprises 60 to 95 wt% organic solvent and 5 to 40 wt% YSZ powder, and 5 to 12 parts by weight of binding agent, 5 to 15 cc plasticizer, 1 to 3 cc homogenizing agent, and 1 to 3 cc dispersing agent are added to a mixture of the organic solvent and YSZ powder based on 100 g of the YSZ powder.

5. The method as set forth in claim 2, wherein the ceramic connector comprises perovskite powder in which Ca, Sr, Mg, Co, or Al is added to $LaCrO_3$.

6. The method as set forth in claim 2, wherein the three kinds of air electrode slurries comprise 10 to 30 wt% $LaSrMnO_3$ powder, 10 to 30 wt% mixed powder of $LaSrMnO_3$ and 20 to 50 wt% YSZ, and 10 to 30 wt% $LaSrCoFeO_3$ powder as starting materials, respectively, and additionally comprise 50 to 75 wt% organic solvent, and 5 to 40 wt% additive.

7. The method as set forth in claim 2, wherein the slurry for the connector plate comprises 20 to 50 wt% $LaSrMnO_3$ or $La_{1-X}Ca_XCr_{1-Y}O_3$ powder, 0.5 to 10 wt% binding agent, 0.2 to 2 wt% solvent, and 0.2 to 5 wt% additive.

8. The method as set forth in claim 2, wherein the slurry for the connector plate containing $LaSrMnO_3$ is sintered at 1100 to 1300℃ under oxygen partial pressure of 10^{-10} to 10^{-3} atm.

9. The method as set forth in claim 2, wherein the slurry containing $La_{1-X}Ca_XCr_{1-Y}O_3$ is sintered at 1150 to 1350℃ under oxygen partial pressure of 10^{-3} atm or lower.